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# TO STUDY THE CAUSES OF HOSPITAL ADMISSION OF CHRONIC KIDNEY DISEASE PATIENTS IN A TERTIARY CARE CENTRE

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## ABSTRACT

**There is a huge load of chronic kidney disease (CKD) patients in India who are at risk of premature morbidity and mortality coupled with inadequate public health infrastructure. Adult patients of CKD admitted in our institute and who gave written informed consent were included in the study. Mean age of subjects in our study was 46.16 ± 15.03 years with 63% of them in 31-60 year age bracket and with male predominance (66%). The etiological factors of CKD were hypertension (66%), diabetes mellitus (22%), glomerulonephritis (14%), obstructive uropathy (11%), and autosomal dominant polycystic kidney disease (5%), with some patients having multiple factors. The common factors associated with hospital admission were severe anemia (50%), metabolic and electrolyte abnormalities (42%), uncontrolled hypertension (25%), Sepsis/ infection (23%) and cardiovascular disease (20%). CKD is associated with a wide range of complications like hypertension, anemia, cardiovascular disease, sepsis and poor quality of life. Therapeutic interventions like early detection and prevention of CKD especially in high risk groups like type 2 diabetes, hypertension and age >60 years will help prevent the large scale morbidity and mortality.**

**KEYWORDS:** Chronic Kidney Disease (CKD), Cardiovascular Disease (CVD), Diabetes Mellitus (DM), Glomerular filtration rate (GFR), Hemodialysis (HD), Hypertension (HTN)

There is a huge load of chronic kidney disease (CKD) patients in India, who are at risk of premature morbidity and mortality. The increasing incidence of CKD is likely because of increasing incidence of diabetes and hypertension in India. In the absence of a renal registry, the actual prevalence of the disease in India is difficult to estimate and is thought to vary from 2.9% to 16.54% in different studies. Further the public healthcare system in India is not well equipped and many patients of CKD die without appropriate treatment (Jacob *et al.*, 2019). The approximate age-adjusted incidence rate of end-stage renal disease (ESRD) in India has been estimated to be 232 per million population, and every year more than 100,000 new patients enter renal replacement programs (Singh *et al.*, 2013), (Modi and Jha, 2006). With such an enormous patient load in the absence of a befitting healthcare infrastructure, interventions like early detection and prevention of CKD especially in high risk groups like hypertension, type 2 diabetes, HIV infection and age >60 years is essential to minimize costs and improve outcomes (George *et al.*, 2017).

The two principal outcomes of CKD are progressive loss of kidney function over time, and the development and progression of cardiovascular disease (CVD). Because many of the kidney diseases start during old age, and rate of decline of kidney function is also usually slow, so most individuals with CKD may not develop kidney failure but they may rather die because of CVD. People with CKD are considered in the highest risk group for subsequent CVD events. Although CVD has high death rate, it is treatable and potentially preventable especially in earlier stages of CKD. Apart from CVD, the decreased GFR in CKD is associated with a wide range of complications, such as hypertension, anemia, malnutrition, bone disease, neuropathy, and poor quality of life (Levey *et al.*, 2005).

Five leading categories of etiologies of CKD which account for > 90% of CKD burden worldwide are diabetic nephropathy, glomerulonephritis, hypertension (HTN) associated CKD (including vascular or ischemic kidney disease and primary glomerular disease with associated hypertension), autosomal dominant polycystic disease (ADPKD) and other cystic and tubulointerstitial nephropathy (Bargman and Skorecki, 2018).

Since our institute was a tertiary care centre with dialysis facilities and CKD patients formed a sizable fraction of hospital admissions, it was decided to study the factors leading to hospital admissions in these patients.

## METHODOLOGY

### Objective

To study the causes of hospital admission of CKD patients in a tertiary care centre.

### Study Design

It was a cross-sectional study conducted in a tertiary care hospital over a period of 6 months from August 2019 to January 2020. One hundred patients were included in the study after obtaining written informed consent. The sample size was kept at 100 for the sake of convenience.

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**Inclusion Criteria**

Patients ≥ 18 years of age admitted with the diagnosis of CKD for indoor treatment and willing to give informed consent were included in the study.

**Exclusion Criteria**

Patients with psychiatric disorders, pregnant females and those not willing to give consent were excluded from the study.

**Diagnosis of CKD**

CKD was defined as kidney damage or glomerular filtration rate (GFR) <60 mL/min/1.73 $m^2$ for 3 months or more, irrespective of cause. The GFR was calculated by CKD-EPI equation (Levey *et al.*, 2009). The CKD-EPI equation, expressed as a single equation, is:

$GFR = 141 * \min(Scr/\kappa, 1)^{\alpha} * \max(Scr/\kappa, 1)^{-1.209} * 0.993^{Age} * 1.018$ [if female] * 1.159 [if black].

Here Scr is serum creatinine (mg/dL), κ is 0.7 for females and 0.9 for males, α is -0.329 for females and -0.411 for males; min indicates the minimum of Scr/κ or 1, and max indicates the maximum of Scr/κ or 1.

**Statistical Analysis**

The recorded data was compiled, entered into a Microsoft Excel sheet and then exported to data editor of SPSS Version 23.0. The distribution of data was subjected to parametric versus non parametric analysis. Parametric data was expressed as Mean ± SD and categorical data was summarized in terms of frequencies and percentages.

## OBSERATIONS

There were total 100 patients; 67 males and 33 females with a mean age of 46.16 ± 15.03 years.

Hypertension associated CKD was the largest etiologic group found in 66% of patients. It was followed by diabetes mellitus (DM) in 22%, glomerulonephritis (GN) in 14%, obstructive uropathy in 11%, ADPKD in 5% and others in 2% of patients (Table 1).

**Table 1: Etiological factors of CKD found in admitted patients (N==100)**

| Sr. No. | Name of the associated factor | Number of patients affected |
|---|---|---|
| 1 | Hypertension associated CKD* | 66 |
| 2 | Diabetes mellitus | 22 |
| 3 | Glomerulonephritis | 14 |
| 4 | Obstructive uropathy | 11 |
| 5 | ADPKD | 5 |
| 6 | Other causes | 2 |
| *Hypertension associated CKD includes vascular or ischemic kidney disease and primary glomerular disease with associated hypertension, ADPKD= autosomal dominant polycystic kidney disease. | | |

GN is a broad pathophysiology and was caused by SLE in 3 patients, hepatitis C in 3, membranoproliferative GN in 2, amyloidosis in 2, human immunodeficiency virus in 1, hepatitis B in 1, celiac disease in 1 and IgA nephropathy in 1 patient. Similarly under the broad category of obstructive uropathy, renal calculi were found in 6 patients, carcinoma cervix in 2 patients, prostatic disease in 2 patients and unknown cause in 1 patient.

Most common factor associated with hospital admissions in our study was severe anemia with mean Hb of 7.73 ± 2.12, seen in 50% patients, followed by metabolic and electrolyte abnormalities in 42%, uncontrolled hypertension in 25%, infection/ sepsis in 23%, cardiovascular disease (CAD, CHF, arrhythmia) in 20%, central nervous system involvement (Stroke 4/uremic encephalopathy 5/ seizures 5) in 14%, acute on chronic kidney injury in 13%, hemodialysis related complications [(intradialytic hypotension (IDH) in 5, dialysis disequilibrium syndrome (DDS) in 4)] in 9%, and other causes in 7% patients (Table 2).

Majority of subjects (60%) were undergoing maintenance hemodialysis with the frequency varying from once to thrice weekly, while the rest (40%) were being managed with conservative medical management; there were no cases of renal-transplant in our study sample. Also most patients belonged to the stage 5 CKD with an average eGFR of 11.48 ± 15.67 ml/min (GFR). The mean creatinine levels were 7.59 ± 3.77 mg%.

**Table 2: Common factors associated with hospital admissions in CKD patients (N=100)**

| Sr. No. | Patient Presentation | Patients Affected |
|---|---|---|
| 1 | Severe anemia | 50 |
| 2 | Metabolic and electrolyte abnormalities | 42 |
| 3 | Uncontrolled hypertension | 25 |
| 4 | Infection/ sepsis | 23 |
| 5 | CVD (CAD, CHF, arrhythmia) | 20 |
| 6 | CNS (Stroke/uremic encephalopathy/ seizures) | 14 |
| 7 | Acute on chronic kidney injury | 13 |
| 9 | Hemodialysis complications (IDH/ DDS) | 09 |
| 10 | Others (Bleeding/ venous thrombosis/ pleural effusion) | 07 |
| CAD= coronary artery disease, CHF= congestive heart failure, CKD = chronic kidney disease, CVD = cardiovascular disease, CNS= central nervous system, DDS= Dialysis disequilibrium syndrome, IDH= Intradialytic hypotension. | | |

## DISCUSSION

Mean age of patients in our study was 46.20 ± 14.76 years with 63% of them in 31-60 year age group, with male predominance (66%). Similar observations were found in other studies also. In a study by Jacob et al mean age was 53.63 yrs and male predominance of 74% (Jacob *et al.*, 2019). In another study by Imtiaz *et al.* mean age was 55 years and males 55% (Imtiaz *et al.*, 2019). As we see the age group in our study was younger probably reflecting a younger population of CKD in our area.

### Etiological Factors

The most common etiologic categories of CKD in this study were hypertension (66%) and diabetes mellitus (22%). Similar findings were documented by Jacob et al and Imtiaz et al, where HTN was found in 61.4% and 86.2% while DM was found in 47.3% and 54.6% respectively (Jacob *et al.*, 2019), (Imtiaz *et al.*, 2019). High blood pressure and poor glycemic control act as initiation as well as progression factors for further deterioration of CKD (Go *et al.*, 2004). Uncontrolled hypertension damages renal glomeruli leading to rapid progression of CKD. On the other hand CKD can exacerbate hypertension due to volume expansion as well as increased systemic vascular resistance. Thus the relationship between hypertension and CKD is cyclic in nature (Buffet and Ricchetti, 2012).

GN was the etiologic category found in 14% of subjects followed by obstructive uropathy in 11% and ADPKD in 5% cases. These are well defined categories of CKD etiology worldwide apart from DM and HTN (Bargman and Skorecki, 2018).

### Causes of Hospital Admission

Among the causes for hospital admission, anemia involved 50% of subjects. Common causes of anemia in CKD are low erythropoietin levels, bleeding diathesis and iron deficiency due to poor absorption. The resultant low tissue oxygen delivery leads to increased cardiac output, ventricular dilation and ventricular hypertrophy and may cause angina or heart failure apart from other symptoms (Bargman and Skorecki, 2018). Severe anemia was associated with hospital admissions of CKD patients in other studies as well (Salman *et al.*, 2018), (Xia *et al.*, 1999).

Electrolyte and metabolic abnormalities (mostly metabolic acidosis and hyperkalemia) were present in 42% of patients and often lead to hospital admissions for optimization. Metabolic acidosis in CKD patients not only leads to protein catabolism but also faster progression of kidney disease and increased mortality. It often precipitates hyperkalemia as well (Adamczak *et al.*, 2018). Hyperkalemia when severe can lead to arrhythmias and sudden death and is therefore an emergency. Hyperkalemia itself leads to impaired ammonia excretion and thus perpetuates metabolic acidosis. Hyperkalemia is often due to contribution from anti-hypertensive medications like angiotensin-converting enzyme inhibitors or angiotensin receptor blockers, poor treatment compliance and non adherence to dietary precautions (Watanabe, 2020).

Uncontrolled hypertension, present in 25% of patients was an important cause of hospital admission. As discussed above, the relationship between HTN and CKD is cyclic in nature; i.e. HTN can be a cause as well as consequence of CKD (Levey *et al.*, 2005), (Go *et al.*, 2004), (Buffet and Ricchetti, 2012).

Infection/ sepsis was another important cause of admission affecting 23% patients. Urinary tract infections (UTIs) were particularly common with obstructive uropathy where they often caused pyelonephritis especially in the setting of hydronephrosis. Infection was found to be the most common cause of hospitalization by

Imtiaz et al affecting 55% of patients out of which UTI was the most common cause (Imtiaz *et al.*, 2019). Ishani et al found that initial dialysis access was the main antecedent of septicemia in CKD patients and this was considered to be an important risk factor for cardiovascular mortality in dialysis patients (Ishani *et al.*, 2005).

CVD in the form of acute coronary artery disease, congestive heart failure (CHF) and arrhythmias (mainly atrial fibrillation) was found in 16% of admitted patients. In a previous study a graded association was observed between reduced GFR and the risk of death, cardiovascular events, and hospitalization in a large, community-based study by Go AS et al (Go *et al.*, 2004). CVD was found to be the most important risk factor of hospitalization in CKD patients by Salman et al (Salman *et al.*, 2018). In a study by Nath and Kashem left ventricular failure was found to be the most common cause of hospitalization (Nath and Kashem, 2019). Cardiac disease was found in 31% of patients in a study by Strijack *et al.*, (2009).

Neurological presentations of CKD patients like stroke (intracranial bleed), uremic encephalopathy and seizures occurred in 14% patients. Dialysis disequilibrium syndrome (DDS) may occur because of rapid changes in urea and other osmolar agents during dialysis which cause cerebral edema; it mostly occurs just after initiation of dialysis or following a sudden change in dialysis regime. These complications are associated with significant morbidity and mortality (Arnold *et al.*, 2016). Kuo *et al.*, in a retrospective study in Taiwan found that incidence rate of stroke (ischemic as well as hemorrhagic) was significantly higher in the HD cohort than in the general population (Kuo *et al.*, 2012).

Hemodialysis complications (IDH, DDS) were seen in 9 cases. DDS has been discussed under neurological presentations. IDH is a common complication of ultrafiltration during hemodialysis and is associated with high mortality and morbidity. Risk factors include patient demographics, anti-hypertensive medication, larger interdialytic weight gain and high ultrafiltration rate. It may cause myocardial hypoperfusion and contractile dysfunction and its consequences (Chou *et al.*, 2017). In a study by Halle et al, IDH occurred in 11.6% of HD sessions (Halle *et al.*, 2020).

Acute on chronic kidney injury: decreased urine output or anuria in CKD means that either kidney failure has occurred or there is acute on chronic kidney disease, which may be reversible. The latter may be due to loss of fluids/ extracellular fluid volume from extra renal causes (eg gastrointestinal losses or overzealous use of diuretics) and is treatable whereas the former would need renal replacement therapy. Thus it was another important cause of hospital admissions and was present in 13% of patients (Bargman and Skorecki, 2018). In patients with CKD, if an episode of superimposed acute kidney injury occurs which requires dialysis, then the chances of recovery of renal function become very low and there is increased risk of death or end stage renal disease (Hsu *et al.*, 2009).

There were 3 cases of exudative pleural effusion, 2 of bleeding and 2 of venous thrombosis at the site of venous access cannulas. In a study by Hrdy et al, catheter related deep vein thrombosis was found in 70% cases for internal jugular vein and 30% cases for subclavian vein. The authors therefore cautioned against cannulation of the internal jugular veins (Hrdy *et al.*, 2017). Patients with CKD have an increased bleeding risk. In a large study, the authors found an incidence rate of bleeding in CKD patients to be more than twice as compared to patients without CKD (Ocak *et al.*, 2018).

## CONCLUSION

CKD is associated with a wide range of complications like hypertension, anemia, CVD, sepsis and poor quality of life. Therapeutic interventions like early detection and prevention of CKD especially in high risk groups like type 2 diabetes, hypertension and age >60 years will help prevent the large scale morbidity and mortality.

## LIMITATIONS

It was a cross sectional study with a small sample size, which obtained a onetime data giving only a glimpse of the total picture. Larger studies are therefore required to get the complete picture.

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